Serial No. 10/551,843 Reply to Office Action January 14, 2008 Attorney Docket No. 010986.56896US

Amendments to the Claims:

The listing of claims will replace all prior versions, and listings, of claims in the application:

<u>Listing of Claims</u>:

- 1. (Currently Amended) A semiconductor device comprising:
 - a silicon substrate;
 - a gate electrode layer; and
- a gate insulation film disposed between the silicon substrate and the gate electrode layer, wherein

the gate insulation film is a high relative permittivity (high-k) film being formed by forming a precursor film consisting essentially of at least one metal and silicon, and performing a nitriding treatment on a mixture of a metal and silicon the precursor film.

- 2. (Original) The semiconductor device as claimed in claim 1, wherein the gate insulation film is formed according to a plasma CVD technology.
- 3. (Original) The semiconductor device as claimed in claim 1, wherein a silicon nitride film is formed as a barrier layer between the silicon substrate and the gate insulation film.

Serial No. 10/551,843 Reply to Office Action January 14, 2008

Attorney Docket No. 010986.56896US

4. (Original) The semiconductor device as claimed in claim 3, wherein the

silicon nitride film is formed according to a direct nitriding technology by

plasma.

5. (Original) The semiconductor device as claimed in claim 1, wherein a

silicon nitride film is disposed on the gate insulation film.

6. (Original) The semiconductor device as claimed in claim 5, wherein the

silicon nitride film and the gate insulation film are alternately laminated on the

silicon substrate.

7. (Original) The semiconductor device as claimed in claim 1, wherein a

buffer layer is formed between the silicon substrate and the gate insulation film.

8. (Currently Amended) The semiconductor device as claimed in elaime

claim 1, wherein an alumina (Al₂O₃) monocrystal film is formed between the

silicon substrate and the gate insulation film.

9. (Original) The semiconductor device as claimed in claim 8, wherein the

alumina monocrystal film is formed according to a plasma CVD technology.

10. (Currently Amended) The semiconductor device as claimed in claim 1,

Page 3 of 11

Serial No. 10/551,843 Reply to Office Action January 14, 2008 Attorney Docket No. 010986.56896US

wherein the gate insulation film has one of compositions selected from a following list:

 $M_3Si_6N_{11}$ (M=La, Ce, Pr, Nd, Sm);

 $M_2Si_5N_8$ (M=Ca, Sr, Ba, Eu);

MYbSi₄M₇ (M=Sr, Ba, Eu);

MYbSi₄N₇ (M=Sr, Ba, Eu);

BaSi₄N₇;

 $Ba_2Nd_7Si_{11}N_{23}$.

11. (Currently Amended) A method for manufacturing a semiconductor device comprising the steps of:

forming a gate insulation film which is a high relative permittivity (highk) film by performing a nitriding treatment on a mixture of a metal and silicon; and

forming a gate electrode layer on the gate insulation film.

forming a precursor film consisting essentially of a mixture of at least one metal and silicon,

forming a gate insulation film by performing a nitriding treatment on the precursor film, and

forming a gate electrode layer on the gate insulation film, wherein the gate insulation film is a high relative permittivity (high-k) film.

Serial No. 10/551,843 Reply to Office Action

January 14, 2008

Attorney Docket No. 010986.56896US

12. (Original) The method for manufacturing the semiconductor device as

claimed in claim 11, wherein the gate insulation film is formed according to a

plasma CVD technology.

13. (Original) The method for manufacturing the semiconductor device as

claimed in claim 11, further comprising the step of forming a silicon nitride film

as a barrier layer between the silicon substrate and the gate insulation film.

14. (Original) The method for manufacturing the semiconductor device as

claimed in claim 13, wherein the silicon nitride film is formed according to a

direct nitriding by plasma.

15. (Original) The method for manufacturing the semiconductor device as

claimed in claim 11, wherein a silicon nitride film is disposed on the gate

insulation film.

16. (Original) The method for manufacturing the semiconductor device as

claimed in claim 15, wherein the silicon nitride film and the gate insulation film

are alternately laminated on the silicon substrate.

17. (Original) The method for manufacturing the semiconductor device as

claimed in claim 11, further comprising the step of forming a buffer layer

Page 5 of 11

Serial No. 10/551,843 Reply to Office Action January 14, 2008 Attorney Docket No. 010986.56896US

between the silicon substrate and the gate insulation film.

18. (Original) The method for manufacturing the semiconductor device as

claimed in claim 11, further comprising the step of forming an alumina (Al₂O₃)

monocrystal film between the silicon substrate and the gate insulation film.

19. (Original) The method for manufacturing the semiconductor device as

claimed in claim 18, wherein the alumina monocrystal film is formed according

to a plasma CVD technology.

20. (Original) The method for manufacturing the semiconductor device as

claimed in claim 11, wherein the gate insulation film has one of compositions

selected from a following list:

 $M_3Si_6N_{11}$ (M=La, Ce, Pr, Nd, Sm);

 $M_2Si_5N_8$ (M=Ca, Sr, Ba, Eu):

MYbSi₄N₇ (M=Sr, Ba, Eu);

BaSi₄N₇;

 $Ba_2Nd_7Si_{11}N_{23}$.

21. (New) The semiconductor device as claimed in claim 3, wherein a

silicon nitride film is disposed on the gate insulation film.

Page 6 of 11

22. (New) The method for manufacturing the semiconductor device as claimed in claim 13, wherein a silicon nitride film is disposed on the gate insulation film.

23. (New) A semiconductor device comprising:

a silicon substrate;

a gate insulation film formed directly on the silicon substrate; and
a gate electrode layer formed directly on the gate insulation film, wherein
the gate insulation film is a high relative permittivity (high-k) film being
formed by forming a precursor film consisting essentially of at least one metal
and silicon, and performing a nitriding treatment on the precursor film.

24. (New) A method for manufacturing a semiconductor device comprising the steps of:

forming a precursor film consisting essentially of a mixture of at least one metal and silicon,

forming a gate insulation film by performing a nitriding treatment on the precursor film, and

forming a gate electrode layer directly on the gate insulation film, wherein the gate insulation film is formed directly on a silicon substrate, and the gate insulation film is a high relative permittivity (high-k) film.